EXPLORING THE RELIABILITY OF THE "PRESENTIMENT" EFFECT

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ABSTRACT

This project extends a series of experiments begun by Radin that appears to demonstrate an autonomic nervous system (ANS) response to future emotionally arousing experiences. This experiment used skin conductance as the ANS measure and was designed to examine test-retest reliability in the "presentiment" effect, also known as "pre-stimulus response" (PSR). The experiment also looked for individual differences in PSR responding using the Myers-Briggs Type Indicator and the NEO-FFI personality inventories.

Volunteer participants completed two sessions of viewing 40 calm and arousing images from the International Affective Picture System (IAPS) while SC was monitored. The PSR window was defined as 3 seconds before stimulus onset, and the measure of PSR was the area between the mean relative SC levels for the two classes of stimuli within the prestimulus window. Significance was determined using a Monte Carlo method. A novel analysis technique of de-trending the SC data immediately before the PSR analysis window was used to counter the possible effect of expectancy and other artifacts. Eighty planned participants were tested. Sixteen were eliminated from further analysis because of lack of any SCRs, leaving 64 participants in the final data pool.

The experiment did not produce overall evidence of a presentiment effect, nor did it demonstrate test-retest reliability. Since this experiment deviated from prior methods of analysis the data were examined without de-trending and automatic artifact removal, but there was still no evidence of a presentiment effect. Of three personality factors previously associated with better ESP scoring, MBTI Extraversion, MBTI Intuition, and NEO Openness, the last two were positively and significantly correlated with individual mean PSR. The data were explicitly tested for the presence of an expectancy artifact by correlating the PSR prior to arousing stimuli with the time since the last arousing stimulus. The correlations for both the de-trended data and the original method of analysis were negligible and non-significant, providing no evidence that an expectancy artifact was present.

INTRODUCTION

Finding evidence of physiological indicators of the operation of extrasensory perception has long been a holy grail of parapsychology (Dean, 1962, 1966; Hartwell, 1978; Levin & Kennedy, 1975; Tart, 1963). Recently, Radin introduced a new method of using physiology to detect possible precognition of future emotionally shocking experiences. Termed "presentiment," Radin's technique makes use of the responses comprising the orienting response (or "flight or fight" response), most commonly the skin conductance response (SCR). In a typical experiment, a participant's physiology is monitored while he or she views a random series of calm or arousing images. In this design, frequently used in emotion research, a participant usually produces a pronounced response, e.g., a rise in skin conductance, about two seconds after a shocking picture appears. Radin, however, looked at the period several seconds *before* the picture was shown and he found that for some participants their skin conductance began rising before a shocking picture was shown, but not before a calm picture. It appeared that the participant's nervous system was anticipating—preparing for, perhaps—a future emotional shock or threat.

Radin reported this finding in 1997 (Radin, 1997) and since then a series of increasingly sophisticated experiments has yielded reasonably consistent results (for a summary see Radin, 2003). Other researchers have replicated the findings (Bierman & Radin, 1997; Bierman & Scholte, 2002). Using a similar design but with a startle response (loud noise) rather than an emotional image, May and Spottiswoode have obtained strikingly successful results (May & Spottiswoode, 2003; Spottiswoode & May, 2003), which they called "pre-sentiment response" (PSR). Very recently, however, the investigators have raised questions about the interpretation of their findings as representing a physiological response by the participant (May, 2004).

As with any new experimental technique in parapsychology, questions have been raised about possible artifacts. At the outset it was recognized that there could be an expectancy artifact, a "gamblers fallacy" of the autonomic nervious system, in which the participant's skin conductance rises more or less monotonically between trials with shocking stimuli. The longer the participant waits, the greater the expectation of a shocking picture and the higher the skin conductance level. Initial considerations indicated this was not a problem (Bierman, 1999; Radin, 1997). Later Dalkvist, Westerlund and Bierman (2002) demonstrated that the expectancy bias remains a problem through elaborate simulations of PSR studies in which the data of individual test sessions were combined in different ways. Dalkvist et al. observed, however, that when data are averaged for the arousing and calm conditions across all participants the bias is not a problem in practice, though it does not disappear completely. Wackermann (2002) has provided a mathematical treatment of the bias. Radin has reexamined some of his past data in the light of these analyses and found no evidence of an expectancy artifact in those experiments (Radin, 2003). For their recent experiments Spottiswoode and May developed an analysis method that controls for the possibility of expectancy artifact (Spottiswoode & May, 2003) as well as a possible position artifact.

Elsewhere I have drawn attention to the range of spontaneous cases where the response by the recipient of the anomalous information is an emotional or feeling response (Broughton, 2002). Stevenson (1970) has studied a number of these cases in detail, termed intuitive cases, and he notes that they often involve appropriate emotional and behavioural responses but little or no imagery of other cognitive content. The most frequent source of spontaneous ESP is in dreams, and these often involve threats to relationships with loved ones (Ullman, Krippner, & Vaughan, 1989), as do many of the spontaneous cases in general (Schouten, 1982). Recent PET studies of dreaming have shown that the REM state of dreaming seems to activate a tight circuit involving the limbic system and visual association areas, but not the primary visual area of the brain, while the prefrontal cortices show decreased activity (Braun et al., 1998).

Coupled with suggestions from experimental research there is reason to suspect that the emotional system of the brain and body play a role in the transduction of anomalous information into appropriate and adaptive responses by the recipient (Broughton, 2002), possibly in an evolutionarily feasible manner similar to Damasio's somatic markers (Damasio, 1994, 1996).

It is tempting to speculate that the presentiment response possibly reflects a fundamental process by which anomalous information becomes an intuition or an intuitive decision that proves to be useful. As a first step toward linking presentiment with intuitive decision-making it is necessary to explore the reliability of presentiment as a human response. If presentiment is reliable—a type of "intuition response"—then it would also be reasonable to expect individual differences in the intuition response. Thus, the primary objective of this project was to establish the statistical reliability of the presentiment response on a sufficiently large population using the skin conductance response obtained by accepted and widely practiced methods. A secondary objective was to demonstrate measurable individual differences in the presentiment response by examining whether it correlates with selected psychological instruments.

METHODS

Overview

The general design of this experiment involved having volunteer participants participate in two sessions of a presentiment experiment, using a methodology similar to that of Radin (Radin, 1997, 2000) and Bierman (Bierman & Radin, 1997). Tests were administered typically at one-week intervals, though that time varied according to individual requirements. Participants also completed the Myers-Briggs Type Indicator (MBTI) and the NEO-FFI personality assessments, prior to the presentiment testing in most cases.

Participants

Eighty-three participants were recruited and tested. Three were discarded before analysis due to equipment failures early in the series, leaving the target number of 80 participants. Upon initial inspection of the skin conductance data, 16 participants were found to have produced no responses in one or both sessions, i.e., no apparent skin conductance responses (SCRs) in a full session. These participants were also discarded, leaving 64 qualifying participants. The qualifying participants consisted of 25 males and 39 females, ranging in age from 19 to 81 and with a mean age of 44.7 (SD = 14.8). Participants were recruited primarily via word-of-mouth or appeals by the experimenter at various meetings or groups of interested persons. Participants were not paid, but were given a formal report of their MBTI results for personal use. All participants executed an informed consent form prior to participation.

Apparatus

Skin conductance was measured using a PSYLAB model SC5-SA monitor and pre-amplifier system manufactured by Contact Precision Instruments of London, U.K. and Cambridge, MA[1]. The SC5 is a 24 bit digitizing monitor with 0.1 µSiemens absolute accuracy, better than 0.001 µSiemens relative accuracy, and a range of 100 µSiemens. It measures directly in units of conductance, using DC coupling with constant voltage excitation.

The SC5 unit samples at 40 Hz and outputs its data in real time via a standard RS232 serial connection to a computer.

Ag/AgCl electrodes of 8 mm diameter (MED Associates model TDE-022-48) were filled with an isotonic electrode paste (MED Associates type TDE 246 Skin Conductance Electrode Paste) equivalent to Lykken and Venables' (Lykken & Venables, 1971) "Unibase".

Emotional pictures were drawn from the International Affective Picture System (IAPS) (Lang, Bradley, & Cuthbert, 1995) and presented on the screen of a laptop computer as described below. To enhance the contrast between the calm and arousing images, only the top 220 and bottom 220 pictures on the arousal scale were used. There are separate scales for males and females in the IAPS system.

A laptop computer (Dell Inspiron 3800 with Windows 98 SE operating system) was used both to present the images to the participant and to collect the skin conductance data. The controlling program was written in Visual Basic 6 by Edwin May of the Laboratories for Fundamental Research and independently tested and modified by the author. Picture selection was randomized using a hardware-based "true" random number generator (model rp1)[2] attached to the parallel port. If the hardware RNG was not available the program defaulted to a fail-safe mode that employed a high-quality pseudo-RNG (Marsaglia & Zaman, 1987). Both RNG systems passed Marsaglia's DIEHARD randomness test and both were tested to confirm adequate randomization of the IAPS image set as used in this experiment. The procedure for determining pictures involved two steps. In the first step both a calm and an arousing picture were selected from the available pool and loaded into memory. Immediately prior to the stimulus presentation another random decision determined which of the two pictures would appear. Thus the decision as to whether to show a calm or arousing picture was made only about a microsecond before the picture appeared on the screen and there was no computer disk movement or other potential source of noise associated with the random decision. The very short time between the random decision and the appearance of the picture eliminates the possibility of any cueing artifacts arising from the equipment.

Picture stimuli were presented to the participant for 3 seconds each with an inter-stimulus interval that varied randomly between 21 and 26 seconds. Images appeared approximately 13 x 17 cm in the center of a black screen.

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[1] Contact Precision Instruments Inc., P.O. Box 2603, London N1, UK. http://www.psylab.com/ .

[2] Rolf Freitag, University of Ulm, Dept. of Semiconductor Physics, Albert-Einstein-Allee 45, 89069 Ulm, Germany. http://hlhp1.physik.uni-ulm.de/~freitag/spinoffs.html.

Skin conductance data were collected continuously during the experimental period via standard Windows API routines. Input buffers were transferred to program data arrays at critical points in the program, for example, immediately prior to picture selection, for accurate synchronization of SC data with the picture events.

Personality assessment

The Myers-Briggs Type Indicator (MBTI) Form G was used with standard response sheets that were scored by a program written by the experimenter. The scoring program checked for data entry integrity and stored results in a database. The MBTI was selected because of a history of demonstrated relationships between MBTI factors and ESP performance.

The NEO-Five Factor Inventory (NEO-FFI) Form S was also used. These were hand-scored by the experimenter. The NEO-FFI has shown some correlations between ESP performance and at least the "Openness to experience" scale and it has also been used in studies of emotional responses to the IAPS picture set.

Both personality tests were normally given to participants and completed prior to the IAPS test sessions although there were a limited number of exceptions to this.

Testing environment

In order to maximize the number of participants, testing was offered with considerable flexibility in location and time. The equipment was portable, so, in addition to the facilities of Intuition Laboratories, participants were tested in their homes or those of friends, and sometimes at their place of work. In some instances, a participant would organize a small group of friends to chat with the experimenter and take part in the experiment. In all cases, the actual test took place in a quiet room (away from any other people, if there were any) with comfortable viewing arrangements. In all cases, participants took both the first and second tests in the same environment. Under these circumstances it was not possible to control closely temperature and humidity, but in all cases these were within the normal "comfort zone" for American households (20° to 25° C).

Testing procedure

After preliminary interactions, the experimenter would lightly wipe the first and second fingers of the participant's non-dominant hand with an ethanol wipe. The prepared electrodes would be fixed to the medial phalanx of these fingers with paper medical tape in a cross fashion to minimize constriction. A minimum of 10 minutes was allowed to elapse during which the experimenter explained the experiment and generally discussed its importance. The participant was seated in a comfortable chair at a convenient viewing distance from the computer screen. The experimenter then loaded the parameter file into the program and entered various session details. Next the program displayed a graph of the skin conductance and the experimenter provided a brief explanation and a demonstration by asking the participant to take a sharp, deep breath (which typically produced a noticeable deflection in the trace). The experimenter then reviewed the sequence of events that would follow and allowed the participant to experience a demonstration trial (always a calm image that was not used in the actual test). When the participant had no further questions, the experimenter reminded the participant to simply sit quietly and watch the pictures, breathing normally and avoiding any large bodily movements if possible. Then the experimenter started the program and left the testing room. At that point the program began collecting SC data and displaying the 40 randomly selected IAPS pictures. The testing time lasted about 18 minutes and on completion a message was displayed thanking and instructing the participant that the experiment was completed and to call the experimenter. No feedback of results was provided at this time, but the experimenter invited the participant to express his or her reactions to the material if they wished and answered any additional questions.

The second test session was held about a week later, although in some cases the interval was longer and, on rare occasion, shorter, when this was necessary to insure that the participant could complete both sessions. The time interval was not thought critical at this stage of the research. For the second session the explanation of the experiment was in the form of reminding the participant what would take place and the demo trial was not used. Each test session used a fresh random sequence of images, so participants saw a different series of pictures on the second visit (apart from any that might have randomly come up in the first session).

After the second test session was completed the experimenter provided the participant with his or her MBTI and NEO-FFI reports with a short explanation of the results.

Hypotheses and planned tests

The two principal hypotheses were (1) that the combined data of all sessions would demonstrate significant evidence of a pre-stimulus effect using the epoch analysis method (difference in area between the arousing SCR level and the calm SCR level in the prestimulus window), and (2) that there would be a positive correlation between the prestimulus responses of the two test sessions for the participants. Hypothesis 1 would demonstrate a replication of previous work and hypothesis 2 is expected on the basis of the nature of human abilities (although replicability in psychological tests is not as reliable as some suppose (see, for example, Kindt, Bierman, & Brosschot, 1996).)

It was hoped that one or more of the various personality factors derived from the two tests would show a relationship with participants' average prestimulus response. In previous standard ESP testing, MBTI factors E (extraversion) and N (intuition) have been shown to be associated with positive scoring (Broughton, Kanthamani, & Khilji, 1989; Honorton et al., 1990), and ganzfeld testing had shown persons with the MBTI profile of ENFP to be good scorers (Honorton, 1992). In the NEO-FFI, only the O (openness to experience) had been associated with good ESP scoring (Broughton & Alexander, 1996). It was, therefore, expected that these personality factors might show a positive relationship with PSR.

Data reduction and analysis

Data reduction and analysis was conducted in close collaboration with Edwin May and James Spottiswoode of the Laboratories for Fundamental Research who were engaged on a similar project using an audio startle stimulus. They introduced the term pre-stimulus response since their stimuli had no affective content, and this term will be used for this experiment.

The original method of analyzing presentiment experiments was to average all arousing trials for all participants and compare the resulting averaged response with the averaged response for the calm trials. Prior experiments defined the prestimulus period as 5 seconds before the start of the stimulus presentation. For a number of reasons, we decided not to follow exactly the original analysis method.

To deal with the possibility of expectation and position artifacts, discussed in the introduction, Spottiswoode and May (2003) developed a method of analysis in which any trend in the data (up, for example, in the case of expectancy, or down in the case of position artifacts) is removed through a curve-fitting technique immediately prior to the pre-stimulus window. With the trend removed, data are clamped to zero at the start of the prestimulus window and the prestimulus response is defined as the area under the curve defined by the relative skin conductance difference. A detailed explanation of this analysis method can be found in Spottiswoode and May (2003).

Pilot explorations with data from similar PSR experiments led to the specification of two additional thresholds for inclusion of PSR data. The pilot data revealed that the PSR "effect," which, if real, is very small, and is very sensitive to non-specific SCRs (NS.SCR) that can occur normally throughout the session, due to the participant moving slightly or just taking a deeper than normal breath. It is not possible to identify and remove these artifacts manually, so two criteria were developed for automatic exclusion. Any changes in the slope of the SCR line within the prestimulus area that fell within the top 2.5% of positive or negative deflections (most extreme 5% of changes in slope) caused the trial to be discarded. Similarly, any shifts in skin conductance level that fall within the top 2.5% of positive and negative excursions (5% total) were excluded as likely artifacts. The cutoffs were derived by examining all slope changes and level changes in the qualifying trials, excluding the prestimulus region and 10 seconds following the presentation of the stimulus. For further details see Spottiswoode and May (2003).

The pilot explorations also revealed that the most efficient window in which to look for a presentiment effect using the curve-fitting approach was 3 seconds before the stimulus onset. This is different from the PSR window used by previous researchers who typically used a 5 second window.

Post-stimulus response amplitudes were computed in the standard way. Only SCR amplitude was used for examination of post stimulus responses.

Lability measures for each participant were calculated by counting the number of NS.SCRs outside the prestimulus window and 10 seconds post stimulus and dividing this by the number of seconds, yielding a NS.SCR/second value.

Spottiswoode and May (2003) have also developed an additional measure for examining prestimulus response. This is simply to count the number of NS.SCRs in the prestimulus window and compute a simple ratio of the average number of NS.SCRs for the arousing condition over the average number of NS.SCRs for the calm condition. The resulting ratio is tested against the expected ratio of 1.0. Spottiswoode and May argue that this may be a better method of analysis for PSR.

The planned hypotheses were to be tested as follows. Hypothesis 1, that there would be overall evidence of a PSR effect, would be tested by averaging the arousing trials and the calm trials for all participants using the curve-fitting method in the pre-stimulus window of −3 to 0 seconds and computing the difference in area under the curves. This is called the prestimulus area difference (PAD) and the analysis method is also known as an epoch analysis. The significance of that difference would be determined by a 20,000 pass Monte Carlo simulation that randomly re-assigned arousing and calm labels to responses. Hypothesis 2, that there would be a positive correlation between participant performance across the two test sessions would be tested using a Spearman correlation on the *z*-score based on the PAD for each test session.

RESULTS

Hypothesis 1 was not confirmed. In fact, there was no evidence of a PSR effect using the planned measure. The Monte Carlo analysis of the overall PAD from the 128 sessions (2 from each of the 64 qualifying participants) yielded a $z = 0.26$ (ns). Figure 1 presents the results.

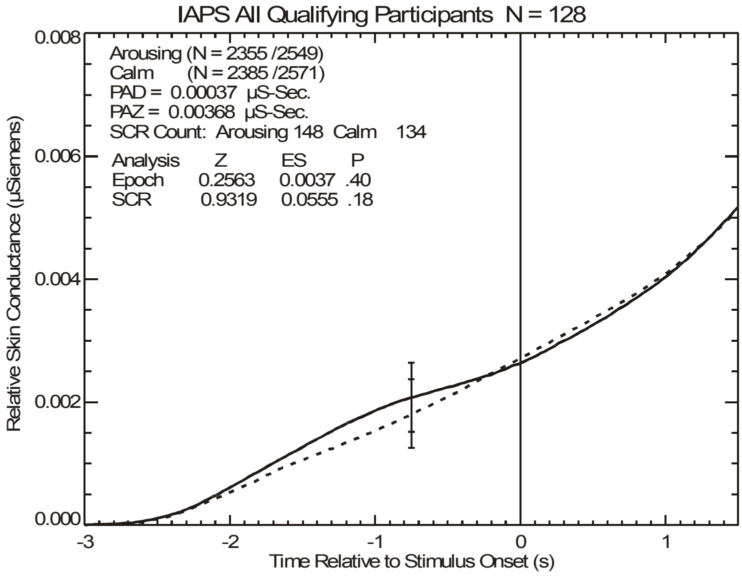

Figure 1: Epoch analysis of 128 sessions. Dashed line is for calm stimuli. N's for each condition represent the number of trials after filtering out of the total number of trials.

Spottiswoode and May's alternative method of evaluation based on the NS.SCRs in the prestimulus window yields a slightly better, but still completely non-significant z = 0.93.

Hypothesis 2, that there would be a correlation between participants' test sessions, as measured by their individual PAD scores, was not confirmed either, r = -.12 (df = 62, p = .35).

To examine the relationship between individual PSR results and the personality tests, a mean z was computed based upon the z-scores associated with the two PAD results for each participant. The continuous scores from the four factors of the MBTI test and the T-scores from five factors of the NEO-FFI were used. Of the nine items, the MBTI SN (sensing-intuition) scale showed a positive and significant correlation with PSR, r =.29 (df = 62, p = .021), as did the NEO Openness scale, r = .32 (df = 61, p = .012). Table 1 shows all correlations.

Table 1 Personality factor correlations with pre-stimulus response

Factor	Pearson r (p)
MBTI Extraversion-Introversion	–.13 (.29)
MBTI Sensing-Intuition	.29 (.02)
MBTI Thinking-Feeling	.05 (.70)
MBTI Judging-Perceiving	.08 (.52)
NEO Neuroticism	–.14 (.26)
NEO Extraversion	.07 (.57)
NEO Openness	.32 (.01)
NEO Agreeableness	.04 (.74)
NEO Conscientiousness	.04 (.73)

Notes: MBTI tests have 62 df, NEO have 61 df (one person did not complete). MBTI E-I scale puts introversion high, thus a negative sign indicates a positive correlation with extraversion. Probabilities are not corrected for multiple analyses.

In light of the comments by Kindt et al. (Kindt et al., 1996) that test-retest reliability in psychology is frequently assumed rather than demonstrated, it seemed appropriate to test the reliability of the *normal* components of the SC response to calm and arousing IAPS pictures. To assess normal reliability I computed the mean relative amplitude of the SCRs for calm and arousing stimuli and the difference between the mean amplitudes for each test session. These measures from the two sessions of each participant were tested in Pearson correlations ($df = 62$ in all cases): Calm amplitude, $r = .47$ ($p = .00009$); Arousing amplitude, $r = .44$ ($p = .0002$); Amplitude difference, $r = .32$ ($p = .009$).

Decomposing the PSR

In a similar experiment using loud audio stimuli for the arousing condition, May and Spottiswoode (May & Spottiswoode, 2003; Spottiswoode & May, 2003) have demonstrated that the principal component of the anomalous PSR is one or more NS.SCRs that occur in the pre-stimulus region of each trial, not the gradual rise in SCL that seems to be the effect in prior research. The apparent rise in SCL may simply be the consequence of averaging many NS.SCRs that occur more frequently before arousing than calm stimuli. To examine the effect of NS.SCRs in the prestimulus region, I compared the basic epoch analysis for those sessions in which there was at least one NS.SCR in the prestimulus region of either a calm or an arousing stimulus with the same analysis done on sessions with no NS.SCRs in the prestimulus regions. The results are shown in Figure 2.

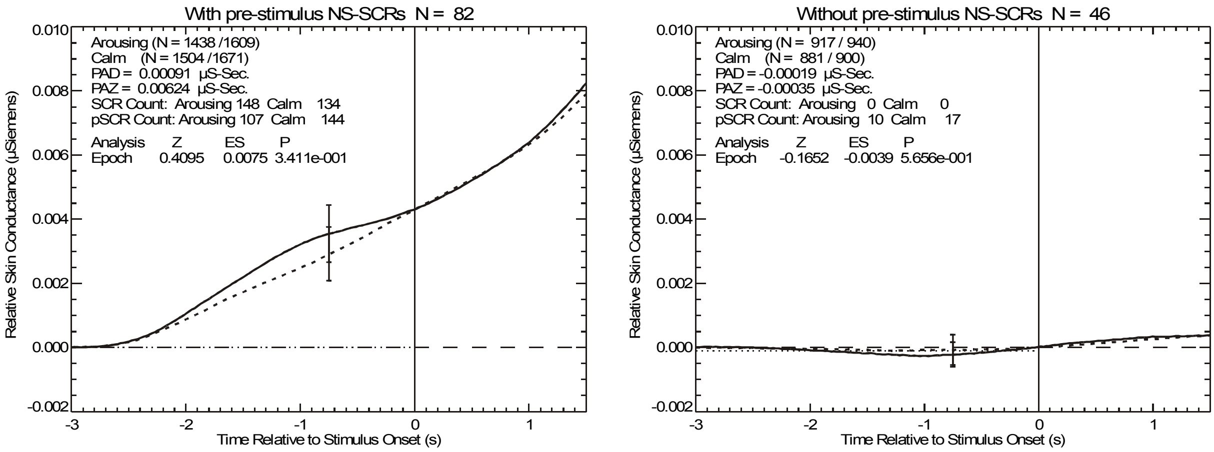

Figure 2: Epoch analysis using trials with NS.SCRs in prestimulus region (left), without NS.SCRs (right). Dotted line represents calm stimuli.

Inspection of the two plots reveals a striking difference. When there are no NS.SCRs in the prestimulus region, there is no increase in SCL prior to either calm or arousing trials.

EXAMINING NORMAL EXPLANATIONS

The overall results of the experiment did not provide a significant confirmation of the hypotheses, yet it is still prudent to examine potential normal explanations for any results obtained.

Randomness of stimuli

Although the true RNG passed exhaustive acceptance tests, it is also necessary to examine its performance in the actual runs used in the experiment. A Wald-Wolfowitz Runs test was applied to the calm-arousing sequences for each of the 128 sessions used. Of the 128 *z*-score results, four were significant, three exceeding the .05 level of significance and 1 falling at the .01 level, which is within normal expectation, indicating that the stimuli conditions were allocated randomly.

Normal expectancy (gambler's fallacy)

Although the experiment did not provide evidence for PSR there was no reason to suppose that it should be any less susceptible to the expectancy artifact. To test for evidence of an expectancy artifact I computed a prestimulus area from zero (PAZ) score representing the area between the SC line and the zero clamping line in the prestimulus region for each trial. For the arousing trials only, I computed a Spearman correlation between the PAZ for the arousing trials and the number of seconds since the last arousing trial (or the start of the experiment where necessary). If an expectancy artifact is present, it should manifest as a positive correlation between PAZ and the time between arousing stimuli.

For the data as used in this experiment, which was de-trended to remove any expectation bias and filtered to remove potentially artifactual NS.SCRs, the result was r_s = .016 (*df* = 2353, $p_{1\text{-}tail}$ = .21). To test the potential effect of an expectancy artifact on more typical data, the PAZ score was computed without de-trending or artifact filtering and used in the Spearman correlation. The result was r_s = .003 (*df* = 2547, $p_{1\text{-}tail}$ = .44). This represents a clear test of the expectancy effect hypothesis. Finally, May and Spottiswoode's alternative method of analysis using the ratio of NS.SCRs was tested by using the count of NS.SCRs before an arousing stimuli instead of the PAZ score. The result was r_s = .013 (*df* = 2547, $p_{1\text{-}tail}$ = .25). In all three tests there was no evidence of an expectancy artifact.

DISCUSSION

This experiment clearly failed to replicate previous experiments that have used a similar design. Since there were a number of differences in the way this experiment was analyzed when compared with previous work, an obvious question is whether the original method of analysis would have yielded better results. The original method used a 5 second PSR window and used simple ensemble averaging rather than the curve-fitted de-trending used here. The simple answer is no, as shown in Figure 3.

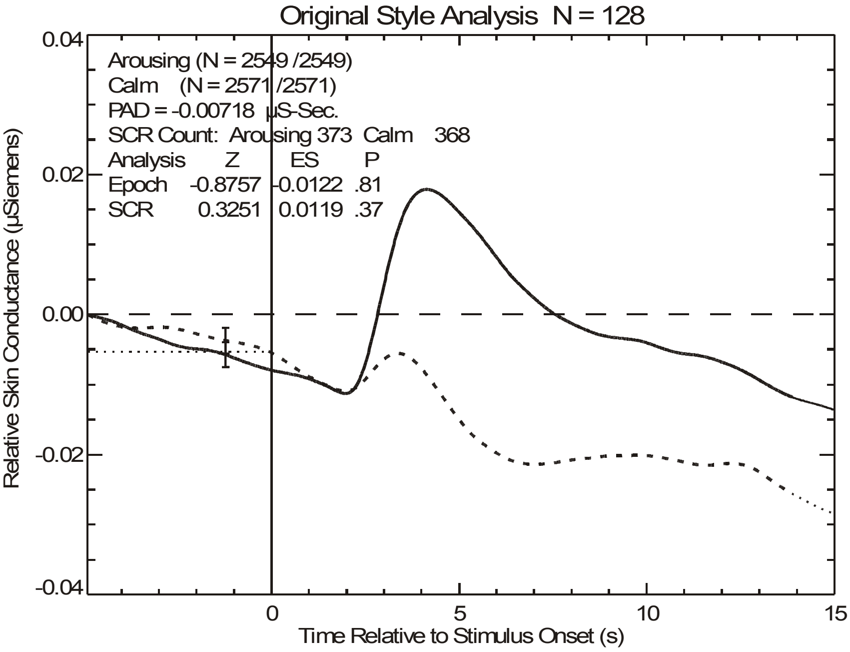

Figure 3: Results of this experiment if it had been analyzed using the "traditional" method. Dashed line represents calm stimuli.

That the experiment failed to demonstrate test-retest reliability is not surprising since there was no primary effect.

Several possibilities may be considered for why this experiment failed to replicate previous findings.

One possibility is that there was insufficient contrast between the calm and arousing pictures. In previous experiments there has not been uniformity in stimuli selection. Some previous experiments have used IAPS images mixed with similar images from unspecified sources, while others have explicitly replaced some of the IAPS pictures (erotic images, for example) with more extreme versions tailored for local conditions. In this experiment I deliberately wanted to stay with the well-tested standard set. It is clear from Figure 3 that the IAPS images had their intended effect on the normal post-stimulus response, so it would be difficult to argue that they were not appropriate for testing the prestimulus effect.

In the similar experiments using audio startle stimuli May has found strong circumstantial evidence that the striking results were due to an experimenter effect (May, 2004). In this scenario, the experimenters used their precondition to begin each test session at the optimal moment to obtain the best fit between the naturally occurring NS.SCRs and the random sequence of stimuli and timing that the computer would generate. Under this analysis the present experimenter simply failed to produce.

On the positive side, of the nine personality factors investigated in this experiment, three have previously been identified as being associated with better scoring in ESP experiments. All three were correlated in the expected direction and two of them, MBTI Intuition and NEO-FFI Openness, were correlated significantly with PSR. Even as one-tailed probabilities they would not survive a correction for multiple analyses, however this result is a promising indication that experiments with more robust evidence of PSR may reveal personality relationships consistent with previous ESP research.

The experiment confirmed what may prove to be an important observation by Spottiswoode and May (2003) that the PSR or presentiment effect may consist of an excess of NS.SCRs in the pre-stimulus region rather than a gradual rise in skin conductance level prior to arousing stimuli that has been presumed to be the basic effect in prior research. Future experiments should plan to examine this issue systematically.

One of the useful findings to emerge from this experiment is that it provides strong evidence that the expectation artifact may not be a serious problem in practice. The complete lack of even a suggestion of a correlation between arousing trial PSRs and the duration from one arousing to the next arousing stimuli indicates that the participants in this experiment were not displaying the anticipation strategies proposed by Dalkvist et al. (2002).

Although this experiment failed to confirm the hypotheses it set out to test, it has managed to apply some promising new tools for the continuing investigation of the prestimulus response or presentiment to emotionally charged materials. Future research should address the relationship between the NS.SCRs and the gradual SCL increase previously taken as the indicator of PSR, as well as the degree to which individual differences play a role in the results.

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